

## ◆ Thermal Test Boards

The TTB-1000 Series of thermal test boards conform to the JEDEC standards defined by the EIA/JEDEC JESD51 series of documents. These boards provide a well defined mounting environment for the thermal characterization and comparison of packages containing either thermal test or application die. Each package lead land is fanned out with an eyelet termination to allow for hand-wired connection to the board edge contacts. The board material will withstand temperatures to 125 °C, allowing the board/package combination to be used for temperature calibration as well as thermal measurements.

The Series consist of three separate groups of boards. The first group is for smaller component packages that fit on a 76.2 X 114.3 mm (3" X 4.5") printed circuit board. These boards are offered in both low thermal conductivity (low  $K_{eff}$ ) and high thermal conductivity (high  $K_{eff}$ ) versions. The former is a board with minimal copper traces on both sides, referred to as a 2s board. The latter is a board with two internal copper planes as well as the surface traces, referred to as a 2s2p board. The second group of boards, for larger component packages having a body dimension  $\geq 27$  mm, has outline dimensions of 101.6 X 114.3 mm (4" X 4.5"), and is also available in low and high  $K_{eff}$  versions. The third group is for special packages, such as Ball Grid Array (BGA) styles, that have special requirements and/or non-standard pinouts. Included in this group are custom boards intended for newly developed packages for which no current standards or standards activity exists; TEA offers these boards designed to conform with the general intent of the JEDEC standards.

## ◆ Thermal Test Equipment for semiconductor devices

Systems designed to facilitate measurement of junction temperature, thermal resistance and thermal metrics for semiconductor devices. Each system is controlled via a graphical user interface, using a keyboard and mouse, with a high resolution video display. A printer is included for hardcopy output of tabular and graphical data. Systems automatically collects data and plots Heating Curves and Cooling Curves. Up to four thermocouples can be simultaneously monitored during the test with built-in capability for measurement of various  $\Psi$  thermal metrics.

<b>TTS-1000</b>	Diode (PN, Schottky, varactor, PIN, laser junction types) measurements with Heating Currents to 10 A (at up to 5 V) over the Heating Time range of 1 ms to 5,000 seconds.
<b>TTS-2500</b>	Transistor (Bipolar, MOSFET, IGBT) and Diode measurements with transistor Heating Power to 200 W (20 V and 10 A) and diode Heating Current to 10 A (at up to 5 V) over the Heating Time range of 1 ms to 5,000 seconds.
<b>TTS-4200</b>	Integrated Circuits and Thermal Test Die measurements with Voltage-Source Heating Power to 100 W (20 V at up to 5 A) or Current-Source Heating Power (10 A with 5 V compliance) over the Heating Time range of 1 ms to 5,000 seconds.

System for the calibration of the semiconductor device temperature sensitive parameter.

**TCS-100** Temperature Calibration System for determining relationship between temperature-sensing junction voltage versus junction temperature of diodes, integrated circuits and thermal test die. Provides internal current sources to 100 mA (at up to 5 V), voltage measurement to 1 mV, and temperature measurement to 0.1 °C. 16-diode capability with Centronics-compatible parallel printer port. Remote system control and data output via serial port currently under development. Optional capability up to 128 diodes.

## ◆ Test Fixtures and Environments

Standard and custom-developed test fixtures and environments for engineering and production thermal measurement requirements for almost any device-type/package combination.

**DCP-100** Dual Cold Plate fixture for validation of detailed and compact thermal models. Supplied with 12-channel thermocouple temperature measurement scanner, regulated pressure for controlling force on package surfaces, and coolant flow rate monitors. Also suitable for junction-to-case thermal resistance ( $\theta_{JC}$ ) measurements. Optional junction-to-board thermal resistance ( $\theta_{JB}$ ) conversion kit extends measurement capability.

**NC-100** Natural Convection (Still Air) Environmental Chamber in conformance with EIA/JEDEC JESD51-2 standard for junction-to-ambient thermal resistance ( $\theta_{JA}$ ) measurements. Includes mating edge-card connector for JESD51 standard thermal test boards.

**WT-100** Designed to conform with EIA/JEDEC JESD51-6 for semiconductor package, device, and heat sink measurements, this wind tunnel is an open-loop vertical design to minimize floor space and maximize ease of use. The air flow section has clear sides for easy observation of flow patterns over the range of 0.5 to 5 m/s. The 20 X 20 cm, 25 cm long test section is equipped with an edge card connector to accept standard thermal test boards; optional blank test wall is available for custom configuration of test sample mountings. Air velocity is controlled by front panel push buttons for increasing/decreasing air velocity.

**CTF-901** Calibration Test Fixture for use with TCS-100 Temperature Calibration System. Accepts up to 8 Thermal Test Boards at a time for use in a temperature-controlled environment up to 105 °C. Universal design allows user to wire fixture to match test board pinouts. Plugs directly into TCS-100 system.

Detailed specifications for each of these products can be found at  
<http://www.thermengr.com>  
(click on Services/Products, then click on Products)